

XXV.—*Descriptions of Palæozoic Corals from Northern Queensland, with Observations on the Genus Stenopora.*  
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[Plate XIV.]

### 1. Introduction.

THE corals about to be described are derived from two sources, viz. a collection from the limestone of the Broken River, made by the late Mr. Richard Daintree, C.M.G., F.G.S., and a second from several localities, made by Mr. R. L. Jack, F.R.G.S., F.G.S., at present Government Geologist for North Queensland.

At the time the "Daintree collection" of Queensland fossils (animal remains) was described by Mr. R. Etheridge, F.R.S.\*, the corals were not included in Mr. Etheridge's report, but, having been placed in our hands for description, are now in the British Museum.

The collection made by Mr. Jack has only reached this country within the last few months; and as a portion of it and of that made by Mr. Daintree are from one district and, in all probability, from the same limestone, or at any rate from a limestone in the same series, the present appeared to us a favourable opportunity for working out the two collections in connexion with one another.

Many of Mr. Daintree's corals are in travelled blocks of limestone, in all probability taken from the bed of the Broken River near the outcrop of the limestone yielding them. In this respect Mr. Jack's collection becomes of essential service, because the corals comprised in it have all been obtained *in situ*, and, in addition to enabling us to show the above supposition to be correct, further indicate that the blocks cannot have travelled far.

The Australian Palæozoic corals have not been investigated to any great extent. The most important memoirs on the subject are:—an appendix to Dr. C. Darwin's 'Geological Observations on Volcanic Islands' †, by the late Mr. Lonsdale, in which the genus *Stenopora* was first enunciated; the remarks by the same author contained in Count P. de Strzelecki's work 'Physical Description of New South Wales &c.' ‡; descriptions by Prof. J. D. Dana in the 'Geology of the

\* Quart. Journ. Geol. Soc. 1872, xxviii. pp. 317-350.

† London, 1844, 8vo, App. pp. 161-163.

‡ London, 1845, 8vo, p. 262 *et seq.*

United-States Exploring Expedition, under Capt. Wilkes, U.S.N.\*; Prof. F. M'Coy's paper "On the Fauna and Flora of the Rocks associated with the Coal of New South Wales" †, containing descriptions of *Cladochonus tenuicollis* and *Strombodes australis*. These, with Prof. de Koninck's 'Recherches sur les Fossiles palæozoïques de la Nouvelle-Galles du Sud' ‡, comprise the more important publications bearing on Australian Palæozoic corals, although there are a number of minor papers which need not now be referred to.

## 2. Geological Notes.

The published information in connexion with the localities or horizons from which the corals about to be described come may be summed up as follows:—

The Broken-River Limestone, represented by the specimens collected by Mr. Daintree, is considered by Mr. R. Etheridge, F.R.S., as the lowest fossiliferous deposit in Queensland. He says, "There cannot now be any doubt that the Broken-River Limestone beds, containing *Favosites* &c. &c., are the lowest fossiliferous deposits in the Queensland area; and their age is undoubtedly Lower Devonian or 'Siluro-Devonian'" §. On this subject Mr. Daintree, who probably had the best knowledge of North-Australian geology, says, "In the limestone bands which form the lower portion of the series" (*i. e.* the Devonian) "corals are very numerous; in fact the limestones, where little alteration has taken place, are a mass of aggregated corals" ||. In addition to these remarks, Mr. Daintree gives a woodcut view of a "Section of Devonian Coral Limestone, Terrible Creek, near Messrs. Cunningham's Cattle Station, Burdekin River, Northern Queensland" ¶, in all probability the very locality from which his corals came.

Two specimens in the Daintree collection are from the Gympie gold-field, in the characteristic green chloritic rock of that district. These beds are also considered by Mr. Etheridge to be of Devonian age\*\*; but Prof. M'Coy is more inclined to regard them as Carboniferous ††.

We now come in due course to the specimens forwarded by Mr. R. L. Jack. From the Bowen-River coal-field there are two species of *Stenopora* from beds which have been shown

\* New York, 4to, pp. 711, 712.

† Ann. & Mag. Nat. Hist. 1847, xx. p. 227.

‡ Bruxelles, 1876, pts. 1 and 2, pp. 140 and 133; 1877, pt. 3, pp. 143-157.

§ Quart. Journ. Geol. Soc. 1872, xxviii. p. 324.

|| Ibid. p. 290.

¶ *Loc. cit.* p. 290, fig. 12.

\*\* Ibid. p. 324.

†† Prodrômus Pal. Victoria, 1874, i. p. 38.

by one of us\* to possess strong *Permo-Carboniferous* affinities. The Fanning-River Limestone has in the same manner been shown to be of Devonian age, by means of the Mollusca there associated with the corals. The age of the Arthur's-Creek Limestone, a new locality, will be commented on at the close of this paper.

### 3. *Lithological Characters of the Specimens.*

We are indebted to our friend Mr. T. Davies, F.G.S., of the British Museum, for the following notes on the lithological characters of some of the matrices containing certain of the corals about to be described.

The fossiliferous rock of Coral Creek consists of an ochreous, concretionary or nodular ironstone, resembling, in a remarkable degree, some forms of bog-iron-ore. In this, in addition to a copious molluscan fauna, occurs *Stenopora Jackii* (nobis). Other nodules occur associated with this, formed of detrital matter, which varies according to the derivative rock, in some cases being more felspathic and quartzose with scales of mica, suggesting a gneissic or granitic rock as the source. These nodules contain *Stenopora ovata*, Lonsdale, in abundance.

The fossiliferous rock of the Gympie gold-field, containing many fossil *Spiriferæ*, *Stenopora?* sp., &c., is of aqueous origin, and consists of the detritus of preexisting metamorphic shales and limestones. Large angular and subangular fragments of a fine-grained chloritic slate occur in a conglomerate of small oval pebbles of limestone, dolomitic limestone, and a siliceous rock. The cementing material consists of the fine-grained comminuted detritus of chloritic schist. Chlorite alone occurs as an incrustation on the contained fossils, more especially upon the remains of the Mollusca.

### 4. *Descriptions of the Species.*

#### Spongida (Stromatoporoidea).

Before proceeding to a detailed description of the corals, we may mention the presence of the genera *Stromatopora* and *Caunopora* in the Queensland limestones—a fact not hitherto recorded, so far as we are aware.

*Stromatopora* occurs amongst Mr. Daintree's fossils from the Broken-River Limestone, but in so highly silicified a state that we have not been able to make a satisfactory examination of the specimen. Another example has been forwarded by Mr. Jack from the Arthur's-Creek limestone,

\* In a paper lately read before the Geological Society of London.

which is very like some of the Devonian species of Devonshire and the Eifel.

The *Caunopora* is also from the limestone of Arthur's Creek, and is apparently distinct specifically from *Caunopora placenta*, Phillips, the characteristic Devonian form from Devonshire.

Pending a detailed and proper description of the Eifel and Devonshire forms of *Stromatopora* and *Caunopora*, we refrain from entering into details concerning these specimens, and hope to be able to do so, with more satisfactory material in our hands, at some future date.

### Class ACTINOZOA.

#### Genus FAVOSITES (pars), Lamarek, 1816.

(Hist. des Anim. sans Vertèb. ii. p. 204.)

*Obs.* The Silurian rocks of New South Wales have yielded no less than five species of this genus, and one doubtful one, to the researches of Prof. de Koninck\*, viz.:—*Favosites aspera*, D'Orb.; *F. cristata*, Blumenbach; *F. fibrosa*, Goldf.; *F. Forbesi*, Edw. & H.; and *F. gothlandica*, Foug. The same author likewise mentions as occurring in the Devonian rocks of New South Wales:—*F. alveolaris*, Goldf.; *F. basaltica*, Goldf.; *F. fibrosa*, Goldf.; *F. polymorpha*, Goldf.; and *F. reticulata*, Blainville. In addition to these, *Favosites gothlandica* was long ago shown to be present in New South Wales rocks by Mr. Lonsdale †; and its existence (as *F. Goldfussi*, Edw. & H.) in the Devonian rocks of Buchan, Victoria, has been pointed out by Prof. M'Coy ‡.

Amongst the Queensland corals are two forms of *Favosites* only separable by the size of the corallites composing the respective colonies. We refer these as follows:—

#### *Favosites gothlandica* (Foug), Lamarek.

*Favosites gothlandica*, Lamarek, Hist. Anim. sans Vertèb. 1816, ii. p. 206.

*Calamopora gothlandica*, Goldfuss, Petr. Germ. 1829, i. p. 78, t. 26. fig. 3, a-e.

*Favosites gothlandica*, Edwards and Haime, Polyp. foss. Terr. Pal. 1851, p. 232.

*Favosites Goldfussi*, Edw. & H. ibid. p. 235, t. 20. fig. 3, a, b.

*Obs.* It will be convenient to consider the form with the smallest corallites as the typical *F. gothlandica*, whilst that

\* Foss. Pal. Nouv.-Galles du Sud, 1876, pts. 1, 2, pp. 20-23.

† Strzelecki's Phys. Deser. New South Wales, 1845, p. 266.

‡ Prod. Pal. Victoria, dec. iv. 1876, p. 15.

with the larger calices may be looked upon as the variety *Goldfussi*. Edwards and Haime regarded *F. gothlandica* as an essentially Silurian species; and the corresponding Devonian form was separated by them under the name of *F. Goldfussi*. The latter is stated by its authors to be distinguished from the former by its larger corallites and more closely set mural pores. The size of the tubes ( $1\frac{1}{2}$  line), however, is frequently exceeded by typical Upper Silurian examples of *F. gothlandica*, notwithstanding their more commonly smaller size. Under any circumstances the size of the corallites merely cannot be regarded as a character of the smallest specific value, while the mural pores exhibit an at least equal variability. Upon the whole, therefore, *F. Goldfussi*, Edw. & H., cannot be satisfactorily separated from *F. gothlandica*, except as a mere variety.

In the specimens here referred to *F. gothlandica*, var. *Goldfussi*, the diameter of the calices, as before stated, is about  $1\frac{1}{2}$  line, in extreme cases reaching as much as  $2\frac{1}{4}$  lines. In one example there are four tabulæ in the space of two lines vertical, whilst in another specimen the same number are contained in a space a little exceeding this. The examples collected by the late Mr. Daintree appear to be only portions of colonies; but, notwithstanding this, one of the specimens, a very fine one, measures  $9\frac{1}{2}$  inches by  $4\frac{1}{2}$ , forming a more or less elongated depressed parallelogram. This form of *F. gothlandica* corresponds in a striking manner with that met with in the Corniferous Limestone of North America, a careful comparison having been made with colonies of the latter coral in the cabinet of one of us.

We now come to four specimens, and possibly a fifth, which we look upon as referable to *Favosites gothlandica* proper, as understood by Messrs. Edwards and Haime. They also bear a close resemblance to *F. epidermata*, Rominger, from the Corniferous Limestone of North America, which is probably, after all, only another variety of the widely spread and typical *F. gothlandica*. In the colonies in question the calices are much smaller, scarcely ever exceeding 1 line in diameter, and frequently less, whilst four tabulæ appear, on an average, to be comprised within the space of  $1\frac{1}{2}$  line vertical. We say on an average, because we find, on the examination of a sufficiently large number of specimens gathered from various quarters, and including those from Australia, that there is every gradation between these two conditions in the size of the corallites and disposition of the tabulæ. It is on these grounds, combined with the variable disposition of the mural pores, that we propose to consider *F. gothlandica* in the wide



sense understood by Goldfuss, before its subdivision by Edwards and Haime.

In the fifth example, previously referred to as probably identical with the other form, the septal spines are well developed.

*Locality and Horizon.* Broken River, a tributary of the Burdekin River, North Queensland. Specimens obtained *in situ* and in partially rounded blocks. Devonian Limestone.

*Collector.* The late Richard Daintree, Esq., C.M.G., F.G.S., &c.

Genus ALVEOLITES, Lamarck, 1801.

(Système des Anim. sans Vertèb. p. 375.)

*Obs.* We have before endeavoured to point out\* the chaotic condition in which the genus *Alveolites* at present rests. The conclusion at which we arrived, after a very careful examination of a large series of corals referable to the *Alveolites-Chaetetes* section of the Tabulata, was:—"Not only does it appear to be evident that the name *Alveolites* covers a number of forms which are not always united by relations of genuine affinity, but even those forms which may be regarded as types of *Alveolites* are only separable from certain allied groups by characters difficult to define or discover, and sometimes of dubious value and uncertain interpretation." Since these remarks were made, *Alveolites* has been the subject of further research by one of us; and in a forthcoming work † it will be shown that this name must be restricted to a small group of species, while many forms which have been indiscriminately assigned to it will have to be distributed amongst other genera.

We have before us two corals from Queensland, which we have not been able to submit to as complete an examination as we should like. One of them is a ramose form of *Alveolites*, accepting that genus as *formerly understood*, with affinities to *Pachypora*; the other is an expanded or lobate species of so-called *Alveolites*.

Under this name there have been described from the Palæozoic rocks of Australia the following species:—The Upper Silurian series of Burrowang has yielded to the researches of Prof. de Koninck ‡ *Alveolites repens*, Fougé, and *A. rapa*, De Kon. The Lower Devonian rocks of the same colony have yielded *Alveolites subæqualis*, Edw. & H., and *A. ob-*

\* Journ. Linn. Soc. Zool. xiii. p. 353.

† H. A. Nicholson 'On the "Tabulate Corals" of the Palæozoic Rocks, with Critical Descriptions of Illustrative Species.'

‡ Foss. Pal. Nouv.-Galles du Sud, 1876, pt. 1, pp. 17, 18, and 77.

*scurus*, De Kon. We may at once state that the Queensland *Alveolites* forwarded by Mr. Jack in no way correspond to any of these; indeed the two new species described by Prof. de Koninck appear to us to be very unsatisfactorily established, and nothing is known of their microscopic structure.

*Alveolites (Pachypora?)*, sp. ind.

*Obs.* A ramose species, with affinities to *Pachypora*, and possibly really referable to this latter genus. It is very like *A. (Cladopora) robusta*, Rominger\*, from the Corniferous Limestone of North America. The surface-characters are much destroyed by weathering; and as its internal structure shows nothing but mural pores and tabulæ, with no special features of interest, little further can be said about it. The coral may at once be distinguished from our *Pachypora meridionalis* by its very oblique tubes and calices.

The largest of the specimens before us (by no means a perfect specimen) is  $3\frac{1}{2}$  inches in length. The distance between two points of bifurcation or dichotomization of the branches is 1 inch 3 lines.

*Locality and Horizon.* Arthur's Creek, Burdekin Downs, Devonian Limestone.

*Collector.* R. L. Jack, Esq.

*Alveolites*, sp. ind.

*Obs.* An expanded, lobate, or palmate form, which, in the present unsatisfactory and chaotic state of *Alveolites*, is very difficult to determine, although, specifically speaking, we do not know any thing precisely like it. Sections show that the corallites were thin-walled and irregular, with mural pores and plenty of tabulæ. With the material before us we feel we should be only unnecessarily increasing nomenclature by bestowing a name, and therefore refrain.

*Locality and Horizon.* Arthur's Creek, Burdekin Downs, North Queensland. Limestone of Devonian age.

*Collector.* R. L. Jack, Esq.

Genus HELIOLITES, Dana, 1846 (?).

(Zoophytes, Wilkes's U.S. Expl. Exped. p. 541.)

*Obs.* The Silurian and Devonian rocks of one or other of the Australian colonies have yielded four species of this genus, so far as present researches have gone; and to these we have to add a fifth and sixth.

\* Foss. Corals of Michigan, p. 54, t. 22, figs. 1, 2.

*Heliolites interstinctus*, Linn., has been met with, according to Prof M'Coy\*, in the Upper Silurian Limestone of Waratah Bay, Victoria. The researches of Prof. de Koninck have shown the existence of *H. megastoma*, M'Coy, and *H. Murchisoni* in the Upper Silurian rocks (probably Ludlow or Wenlock) of New South Wales, at Burrowang†, whilst the Devonian of the same colony has yielded *H. porosa*, Goldf. ‡

*Heliolites porosa*, Goldfuss.

*Astræa porosa*, Goldfuss, Petr. Germ. 1823, i. p. 61, t. 21. fig. 7.

*Heliolites porosa*, M.-Edwards and Haime, Polyp. foss. Terr. Pal. 1851, p. 218; Mon. Brit. Foss. Corals, 1853, pt. 4, p. 212, t. 47. fig. 1, a-f; De Koninck, Foss. Pal. Nouv.-Galles du Sud, 1876, pt. 1, p. 81; Etheridge, jun., Cat. Australian Foss. 1878, p. 37.

*Obs.* Under this name we have assembled a series of specimens from three localities in North Queensland, varying more or less slightly in their characters amongst themselves, but which we think are all referable to *Heliolites porosa*, Goldf. The composite corallum in these corals is massive, with a flat under surface or base, having few and faintly marked concentric ridges. The calices in all the specimens are circular, pretty equally developed in the same individual, and separated by unequal interspaces occupied by cœnenchymal tubes§; each calice varies from  $\frac{1}{2}$ – $\frac{2}{3}$  of a line in diameter. The tubes of the cœnenchyma are rather small and polygonal, and constitute somewhat large interspaces between the corallites. The septa are only visible here and there.

Upon comparing a series of specimens of *H. porosa* from German and British Devonian rocks we find that considerable variation takes place,—1st, in the diameter of the corallites themselves; 2nd, in the size of the cœnenchymal tubuli; 3rd, in the amount of intercalicular space occupied by the latter; and 4th, in the length of the septa. These variations are, indeed, shown in the figures given by MM. Milne-Edwards and J. Haime. So far as we are able to judge, the Queensland examples appear to occupy a median place in the above scale; the diameter of the corallites and cœnenchymal

\* As *Palæopora*, in Progress Report for 1876, no. iv. Geol. Survey Vict., by T. Couchmann, pp. 156, 158 (Melbourne, 8vo, 1877).

† Foss. Pal. Nouv.-Galles du Sud, 1876, pt. i. pp. 24, 25.

‡ Ibid. p. 81.

§ In this and in the following descriptions of species of *Heliolites* we use the terms "cœnenchyma" and "cœnenchymal tubes" simply in accordance with previous custom, and for the sake of convenience. There is, of course, no true "cœnenchyma" in *Heliolites* and its allies; and the so-called "cœnenchymal tubes" are really a specialized series of small corallites.



tubuli is greater than in some European examples and less than in others. On the whole the interspaces occupied by the tubuli are perhaps greater in the Queensland examples.

In vertical sections we can distinguish with ease the tabulæ as described by Edwards and Haime, horizontal, but sometimes oblique. These authors describe the cœnenchymal tubuli as "nearly regularly hexagonal." Certainly this is the case with some of the tubes on various parts of the Queensland specimens; but we find by far the commoner form is the polygonal.

*Locality and Horizon.* Broken River, North Queensland, in rolled blocks (*Daintree*); Limestone of the Fanning River, Burdekin Downs, N. Q., *in situ* (*Jack*); Limestone of Arthur's Creek, Burdekin Downs, *in situ* (*Jack*). Devonian.

*Collectors.* The late R. Daintree, Esq., and R. L. Jack, Esq. (*Coll. Geol. Survey of North Queensland and Brit. Mus.*)

*Heliolites Daintreei*, Eth., Jun., and Nicholson.  
(Pl. XIII. figs. 3, 3a.)

*Spec. char.* Corallum compound, discoid or flattened; upper surface a little convex; under surface more or less flattened, concentrically wrinkled round the edges. Calices large, equal in size, with a diameter of  $\frac{3}{4}$  line, or at times almost 1 line, closely set; calicular edge deeply scalloped. Septa numerous and well-marked, certainly fourteen and sometimes more, unequal in size. Cœnenchyma composed of large and well-developed tubes separating the corallites by irregular interspaces, often of small extent. A specimen measures  $3\frac{1}{2}$  inches by nearly 4.

*Obs.* We have separated from the foregoing specimens one which appears to us to possess characters sufficiently worthy of specific distinction.

It may be distinguished by the size and contiguity of the large corallites, with their strongly scalloped margins. The cœnenchymal tubuli are irregularly developed; for between neighbouring calices we occasionally see only one row of tubes, but more commonly the number is increased to two. The latter number varies up to three or four, beyond which we have not observed them to be increased.

In the contiguity of its calices and frequent diminution of the tubuli, *H. Daintreei* resembles *H. megastoma*, M'Coy, of the British Silurian rocks, but is at once distinguished by the prominent scalloped edges of the calices, and the flat or little-convex form of the corallum.

In the contiguity of the corallites one to the other there is

a good deal of resemblance between our *H. Daintreei* and *H. pyriformis*, Lonsdale, as figured by Hall from American specimens; but the other characters are quite dissimilar.

*Locality and Horizon.* Broken River, North Queensland, as a rolled block.

*Collector.* The late R. Daintree, Esq.

*Heliolites*, sp. ind.

*Obs.* A third and small species of *Heliolites* is represented by a single example nestling in the middle of a large block of *Favosites*. The calices and cœnenchymal tubuli are very small, the latter so much so that the use of a lens is required for their detection. The corallites are circular and possess very thin and thread-like margins, and they are separated from one another by intervals of cœnenchyma of some extent.

The tubes of the latter are very small and almost microscopic, hexagonal or polygonal.

In a vertical section the structure is characteristically Heliolitiform. In the interspaces between the corallites the small square cells, making up the cœnenchyma, are quite apparent, but rather unequal in size. The tabulæ in the corallites are moderately close and horizontal.

We have observed traces of very small septa remaining in one or two of the corallites; but their structure is so delicate and minute that their preservation is surprising. We think it very probable that this is an undescribed minute *Heliolites*; but as we have only one example before us, we refrain from committing ourselves to a name. It appears to be smaller in general than any of the commoner species of *Heliolites* known to us, especially as regards the size of the cœnenchymal tubes.

*Locality and Horizon.* Broken River, North Queensland, in a large block of *Favosites*. Limestone of Devonian age.

*Collector.* The late R. Daintree, Esq.

*Heliolites plasmoporoides*, Eth. Jun., and Nicholson, sp. nov.  
(Pl. XIII. figs. 2, 2b.)

*Spec. char.* Corallum irregularly ovate; upper surface convex. Calices circular, with a thin thread-like margin, average diameter  $1\frac{1}{2}$  line, contiguous, but separated from one another by small interspaces of cœnenchymal tubuli. The latter are large and of very irregular form: some are elongate, with one axis much longer than the other; others are polygonal; and, again, others are without definite outline. Between contiguous corallites there is usually but one row of large oblong interstitial tubes, reaching from calice to calice;

or, where the corallites become a little separated from one another, these may be increased in number. Septa almost obsolete, thread-like. A specimen measures 5 inches by 4.

*Obs.* The form and arrangement of the cœnenchymal tubuli render the present species a very interesting one. If horizontal sections in the mass are examined only with the naked eye or ordinary lens, the species will be pronounced a *Plasmopora*; and this it at first appeared to us to be. It has all the general appearance of this genus, especially in the fact that there is often but a single row of oblong interstitial tubes between every two corallites. In such sections the walls of these tubes have quite the appearance of thread-like costæ radiating from corallite to corallite, or bifurcating at various angles where their number is increased between the corallites, as in *Plasmopora*. When, however, vertical microscopic sections are examined, the true affinities of this peculiar coral at once become apparent. In the first place, the arched and vesicular tabulæ of *Plasmopora* are wanting, and we find in their place the straight horizontal diaphragms of *Heliolites*. Secondly, in similar sections the interstitial or cœnenchymal structure is found not to consist of vertical canaliculi formed by the irregularly-developed walls of the tubuli, and subdivided by horizontal or convex dissepiments into irregularly formed cells, as in *Plasmopora*, but of a series of small regular and well-developed cells formed by the intersection of the vertical tubuli and their horizontal tabulæ, which are usually placed on the same level and correspond with one another, precisely as seen in vertical sections of *Heliolites megastoma*, M'Coy.

In working out this interesting coral we have made a series of microscopic sections of *Plasmopora petaliformis* and *Heliolites megastoma*, for comparison with those of the Queensland fossil; and these have enabled us to indicate *Heliolites* as the proper resting-place for this otherwise very *Plasmopora*-like coral.

So far as our investigations enable us to form an opinion, *H. plasmoporoides* is most nearly allied to *H. megastoma*, M'Coy; indeed, in the figure of this species given by Edwards and Haime we notice the one-celled disposition of the cœnenchyma in places, similar to that seen in the present species. The latter, however, is clearly distinguished from *H. megastoma*.

*Locality and Horizon.* Broken River, a tributary of the Burdekin River, North Queensland. Devonian Limestone.

*Collector.* The late R. Daintree, Esq.